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# INTRODUCTORY LECTURE

TO THE

## COURSE OF CHEMISTRY,

DELIVERED IN

JEFFERSON MEDICAL COLLEGE,

NOVEMBER 3, 1841.

BY FRANKLIN BACHE, M. D.

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## CORRESPONDENCE.

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PHILADELPHIA, Nov. 10, 1841.

DEAR SIR—Agreeably to the wishes of the gentlemen composing the Jefferson Medical Class, expressed at a meeting held on the 9th inst., the undersigned, being appointed a committee for that purpose, request you to have the goodness to transmit to us a copy of your scientific and highly eloquent Introductory Lecture for publication.

The committee beg leave to state, that your compliance will ever be regarded as a source of the most grateful remembrance.

We have the honour to subscribe ourselves,

Yours, most respectfully,

D. T. TRITES, of Pa.,  
B. F. REA, of Geo.,  
G. B. WEISER, of Pa.,  
J. E. FORD, of Va.,  
H. M. WHITAKER, of Ky.,  
J. BRINGHURST, of Del.,  
E. B. RICHMOND, of N. J.,  
E. BROWN, of Ohio,  
W. H. SCOTT, of Pa.

To Prof. FRANKLIN BACHE.

PHILADELPHIA, Nov. 13, 1841.

To Messrs. D. T. TRITES, B. F. REA, G. B. WEISER, J. E. FORD, H. M. WHITAKER, J. BRINGHURST, E. B. RICHMOND, E. BROWN, and W. H. SCOTT, Committee of the Class of Jefferson College:

GENTLEMEN,—I yesterday received your note, addressed to me in behalf of the Medical Class of Jefferson College, requesting a copy of my Introductory Lecture for publication. I feel much gratified by this mark of respect on the part of the Class, and cheerfully comply with their request.

I am, Gentlemen, very respectfully,

Your friend,

FRANKLIN BACHE.

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F. Franklin Bachelder, Esq.

## INTRODUCTORY.

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Having been honoured by the Trustees of this College with the appointment of Professor of Chemistry in the Institution, it would be affectation not to confess that, upon entering on its duties, I experience many conflicting feelings. I am about to undertake a most responsible duty, that of teaching an important science in its application to medicine. I also stand, in my new position, in a more extended relation than heretofore to the public, and where my success or failure will be more operative, either for good or for evil.

The domain of human knowledge is so vast, that no intellect, however gigantic, can explore all its departments, much less embrace its details. The great Bacon may lay down the rules for the right use of reason in interrogating nature ; the vast mind of Newton may scan the heavens, and bring all the celestial phenomena under one law, forming a sublime example of generalization ; yet neither of them could possibly have become acquainted with all the branches of knowledge ; for the life of man is too short. Hence the necessity of classification, which, while it aids the conception of the whole, allows many labourers in the field, each intent upon his own department, and furnishes the means of forming a stock of knowledge, constantly increasing from generation to generation.

All the objects of human inquiry may be referred to the two heads of mind and matter. Those which relate to mind form psychology or metaphysics ; while those which relate to matter are referred to the department of physics. The phenomena of vitality form, as it were, a middle region between mind and matter, referred to the operation of an immaterial principle by some ; and by others to matter manifesting peculiar properties as the result of organization. Considered as an immaterial principle, life must not be confounded with mind ; for no rational person can fail to perceive the unity of the phenomena of vitality, whether manifested by the simplest vegetable that grows, or by the most highly organized animal. If, on the other hand, vitality be held to be the result of organization solely, all its phenomena should be susceptible of

explanation by the same laws that regulate inorganic matter. But this is not the case. A strong line of demarkation separates living from dead matter ; and, without attempting a generalization which the present state of our knowledge does not warrant, it is best to investigate matter to which vital properties are attached, as a separate department of knowledge, and as regulated by peculiar laws.

Under the limitations above mentioned, physics may be defined to be that division of science which investigates the properties of matter not manifesting vital phenomena. The investigation of matter to which vital properties are attached forms the science of physiology.

The science of physics is so extensive that it requires subdivision for its convenient study. When it takes cognizance of the reaction between different masses, or between masses and particles, it constitutes natural philosophy. When it investigates the reaction between particles, as contradistinguished from masses, it forms the science of chemistry.

Chemistry itself may be subdivided according to its applications. Thus we have technological chemistry, or its application to the arts generally, agricultural chemistry, pharmaceutical chemistry and medical chemistry.

It is pharmaceutical and medical chemistry which it is my duty more particularly to teach in this College. And here, gentlemen, let me stop to inquire, is chemistry, in its applications to medicine and pharmacy, worthy of your regard ? This is an important preliminary question ; for if you follow the ensuing course under the erroneous impression that you can be respectable physicians without being chemists, your attention will flag, and the knowledge which you will derive from my lectures will be insignificant ; but if I can convince you in the outset that an intimate connection subsists between chemical and medical science, and that a knowledge of chemistry is an indispensable prerequisite to the successful prosecution of your profession, I shall hope to secure your undivided attention.

The applications of chemistry to medicine will now be briefly noticed ; and first, of its application to physiology.

Although it has been conceded that vital phenomena must be considered as regulated by a distinct set of laws, yet it does not follow that they cannot be elucidated by chemistry. Vital phenomena are the result of the reaction of organic particles ; chemical phenomena,

of inorganic ones. Hence physiology and chemistry agree in studying molecular attractions, occurring either within or without the precincts of vitality. As the anatomist separates the grosser parts, and detects differences in structure ; so the chemist executes a more minute dissection, by demonstrating the chemical nature of the different animal solids and fluids. Thus it is that the science of physiology is based almost entirely upon the facts furnished by anatomical and chemical research.

The subject of alimentary substances requires for its elucidation the aid of chemistry. By its means, the different kinds of food are analyzed, whether derived from the animal or vegetable kingdom, the peculiarities of each noted, and the relation which these peculiarities may bear to their nutritive power. In experiments relating to the vital process of absorption, the physiologist can hardly proceed a single step without the aid of chemical knowledge. The tracing of different substances, purposely introduced into the stomach to determine whether they afterwards pass into the blood and secretions, can only be performed by chemical tests, capable of detecting minute portions of matter, which elude the observation of the senses.

The process of digestion cannot be successfully studied without the aid of chemistry. It is impossible to give an account of what is known in relation to this subject without constantly recurring to chemical principles. The gastric juice has been examined by a number of able chemists ; still much remains obscure and unexplained. Its power, out of the stomach, to dissolve various alimentary substances, was demonstrated by Spallanzani and others ; but for the production of true digestion, the nervous influence appears to be necessary.

Of all the functions of the body, none have received more important elucidations from chemistry than that of respiration. Here true chemical changes take place, as is proved by a comparative analysis of the air taken into the lungs, and that expired. The chief product is carbonic acid, and hence it is fair to infer that charcoal undergoes a change in the lungs, similar to that which it suffers when it burns in the open air. Here, then, is a source of a large amount of heat ; and, no doubt, the temperature of the body is mainly kept up by the function of respiration.

If chemical principles alone cannot explain the function of respiration, it does not, therefore, follow that the changes which the air actually undergoes are the less important to be known ; since a knowledge of these changes may lead to the enlargement of our

resources in combatting disease. It has been found that the formation of carbonic acid, in respiration, is diminished by sleep, by the use of spirituous and fermented liquors, and by the constitutional effects of mercury; while it is increased by muscular exertion and by the exhilarating passions. In what comparative quantities this acid may be generated in different diseases, no extensive series of experiments have yet been instituted to determine; but it cannot be deemed an unreasonable conjecture, that, in disease, important differences may be found to obtain in the products of the respiratory organs.

Another important function is the production of animal heat, which cannot be successfully studied without a due knowledge of the properties of caloric, a subject which belongs to chemistry. Here is required of the physiologist a clear idea of quantity of heat, as contradistinguished from temperature; of changes of state of aggregation produced by caloric; and of the circumstances under which it is absorbed and given out. In relation to the constant liberation of caloric in the animal economy, which maintains a nearly uniform temperature, it may be said that one general principle prevails; namely, that, when, in any vital action, liquids are converted into solids, heat is evolved.

The mysteries of the nervous system are more likely to be explained by studying the imponderable fluids than in any other way. Mere volition causes muscular motion; and the seat of exertion seems to be in the muscle moved; but, in fact, its source is either in the brain or spinal marrow. That the exertion is thence propagated, is proved by the effect of cutting a small fibre, called a nerve, which forms the channel of communication between the brain or marrow and the muscle; whereupon the will becomes utterly powerless. The instantaneous power of volition in propagating an effect through the channel of a nerve, as it were through a conductor, naturally suggests the hypothesis of the passage of a fluid; and, from the analogy of the effect to electrical and galvanic phenomena, leads at once to the plausible conjecture that the fluid in question is some form of electricity or galvanism. What sustains this view are the well known facts that a muscle, recently separated from an animal, suffers violent contractions when a galvanic current is passed through it; and that nature herself has endowed certain animals having the nervous system largely developed, as the torpedo and other electrical fishes, with the power of giving electrical shocks. Besides, the experiments of Dr. Wilson Philip prove, that digestion,

and other functions dependent on nervous influence, after having been arrested by the division of the nerve going to the organ, may be restored by passing a current of the galvanic fluid from one cut extremity to the other.

But it is not merely the healthy economy, whose functions are elucidated by chemistry. Many subjects, connected with pathology, receive important aid. In the treatment of the morbid effects of poisons, chemistry furnishes almost our only resource. By suggesting what substances, by chemical affinity, will unite with the poison, so as to render it inert, or comparatively harmless, we are instructed in the knowledge of counter-poisons. Thus, for preparations of antimony, the best antidote is a decoction of some astringent vegetable; for nitrate of silver, common salt; for baryta and lead, solutions of Epsom or Glauber's salt; for oxalic acid, chalk or magnesia; for corrosive sublimate, the white of eggs; and for arsenic, the hydrated sesquioxide of iron.

In calculous disorders, the physician cannot determine the proper curative measures without the aid of chemistry. Here it is necessary to know the chemical composition of the urine in health and disease, and to possess accurate analyses of the different kinds of gravel and urinary calculi. Without this knowledge, the practitioner is unable to discriminate between the different diseases of the kidneys, or to apply the appropriate remedies, which, for the most part, rest upon chemical principles for their efficacy.

But it is not only physiology and pathology that are indebted to chemistry. The department of *Materia Medica*, also, is under great obligations to it. Here we find a great number of remedies which are the products of the laboratory. To prove this, it is only necessary to remind you of the long catalogue of acids, alkalies and salts, furnished by chemistry to the *Materia Medica*, and to allude to the inestimable value of the native organic alkalies, extracted from some of our most important vegetable remedies. Of these, I need merely name to you quinia and morphia, to call up the recollection of disease arrested as if by a charm, of pain assuaged, and of valuable lives, under the blessing of Providence, snatched from impending death.

The importance of chemistry as a means of detecting adulterations is so obvious, as scarcely to need enforcement by argument. Let it not be said, however, that, important as this knowledge may be, its possession is valuable only to the apothecary. For, if it be essential that a workman should be able to judge of his tools; how

much more important must it be to the physician to possess the necessary knowledge to determine the quality of his medicines, so as to assure himself of their uniform strength, and freedom from injurious impurity.

Chemistry is connected with one branch of medical jurisprudence ; namely, that of searching for deleterious agents in cases of suspected poisoning. Here the chemist comes to our aid, and, by examining the substance supposed to contain the poison by means of appropriate reagents, determines the question with an accuracy and certainty which are truly surprising. To perform these delicate researches, medical practitioners, in this country, are generally called on ; and, unless they possess a knowledge of the chemical qualities of the more important poisons, they cannot conduct the necessary examinations, or give the requisite evidence in a court of justice.

I have thus, Gentlemen, presented to you a sketch of the more important applications of chemistry to medicine. I trust I have made out a case, and convinced you of the intimate connection between the two sciences ; a connection which cannot be disregarded even by the routine practitioner, much less by the scientific physician.

But it may be said that much of the chemical knowledge I have insisted on, is not essentially necessary to the practitioner. It may be alleged that a physician can pursue his profession, without being conversant with chemical physiology and pathology ; without knowing the sources and mode of preparation of his chemical remedies ; and without being acquainted with the signs of the purity of his medicines. For example, he may prescribe calomel, without knowing that it is a metallic preparation, and may, possibly, have studied its physiological and therapeutical effects. I am willing to grant all this ; but he may prescribe the same medicine, without knowing that there is such an organ as the stomach ! Would this be a valid argument against the indispensable importance of anatomy ? No, Gentlemen, we must not listen to such arguments, which, if admitted, would degrade a noble profession below the level of the meanest trade. The students of this college will never condescend to calculate what is the lowest amount of knowledge which may enable them to write a prescription, and drag along in obscurity, with professional attainments barely sufficient to screen them from merited contempt.

But, Gentlemen, chemistry, as a science, has general merits, in-

dependently of its application to our profession. Its study enlarges the mind, and presents us with many phenomena, pre-eminently striking and beautiful. Surrounded as we are by the material world, and dependent on it for our comforts, our pleasures, nay, our very existence, we must be sensible how important it is for us to become thoroughly acquainted with the nature of matter. Would it be pardonable in a physician to be unacquainted with the chemical properties of the air we breathe, or of water, which is so essential to the maintenance of life, and which constitutes nine-tenths of our blood, and forms the basis of all the fluids of the body? Independently of the indispensableness of air to life, both animal and vegetable, it is the agent by means of which we speak and hear, and are enabled to perceive odours. Without it, fire could not be sustained, the infant could not draw sustenance from its mother's breast, water could not be raised in a suction-pump, and the familiar operations of leeching and cupping could not be performed.

The pressure of the atmosphere, on which all the phenomena vulgarly attributed to suction depend, was not understood by the ancients, who attributed the rise of water in a pipe by suction to nature's having a horror of a vacuum or empty space. Indeed, it was not until the time of Galileo, that the true cause was pointed out. At first the Italian philosopher, upon finding that water would not rise higher by suction than about thirty-two feet, concluded that nature's horror was not strong enough to sustain a taller column; but, afterwards, the true cause occurred to him to be the pressure of the atmosphere; a conjecture fully confirmed by his pupil Torricelli, who found, upon filling a long glass tube with mercury, and inverting it in a basin of the same metal, that a column was sustained of variable height, the variation being dependent on the state of the atmosphere. To put this explanation beyond all cavil, Pascal proposed to carry the mercurial tube to the top of a high mountain, where, if the alleged cause were the true one of the support of the column, it ought to sink; as there, the superincumbent atmosphere must be less than in a lower situation. Upon making the experiment, the result fully confirmed Torricelli's views.

The subject of the pressure of the atmosphere belongs to natural philosophy; but its applications are so numerous to chemistry and medicine, that it requires to be explained in a chemical course.

Before the year 1757, atmospheric air was the only aërisform fluid known; the chemist now enumerates more than twenty-five different kinds, all possessing distinctive properties. Among these, some

are pre-eminently supporters of life and combustion, while others are destructive to both ; some possess acid, and others alkaline properties. Notwithstanding this remarkable diversity in chemical characters, they are, for the most part, invisible like common air, and not to be distinguished from it by the sight.

In the whole range of chemical phenomena, none afford such striking results as those dependent on combustion. Were it not for our familiarity with the ordinary forms of this process, we should view the burning of a candle, or even of our common fires, with awe and astonishment. Generalizing the circumstances under which ordinary fire is excited and extinguished, the common observer cannot conceive of its production without the aid of an increased temperature, or of its continuance as compatible with the presence of water. Entertaining these views, how striking must it appear to the beholder, to witness the spontaneous combustion of copper and antimony in chlorine, and of potassium on ice itself. A still more remarkable instance of the production of heat and inflammation is furnished in Döbereiner's lamp, in which the contact of a cold inflammable gas causes a red heat in an equally cold metallic powder, with the result of inflaming the gas.

The discoveries in chemistry, in some instances, do not lead immediately to important results. When platinum was discovered, much interest was felt upon the announcement of its high specific gravity and great infusibility. It was not until many years afterwards that its utility in the arts, and its invaluable properties as an agent in delicate operations of analysis were ascertained. It may, indeed, be asserted that chemistry could not have reached its present advanced state, without the resources placed at the disposal of the chemist by this remarkable metal.

Discoveries of importance have not unfrequently resulted from the examination of residuums, which habit had led the operators previously to throw away. In 1812, a soap manufacturer of Paris discovers that the residual liquor of his lye, after the alkali has been extracted, causes him loss by corroding his copper boilers. This leads him to get the liquor examined, and the result is the discovery of a highly important element, iodine. Curiosity is aroused on the announcement of its remarkable qualities, and in a short time its more important properties are fully ascertained. The new substance is traced to the kelp used by the manufacturer ; next to sea-weeds, from which the kelp is obtained by burning them to ashes ; and finally to sea-water itself. It is soon after found in

salt-mines and springs, and in many marine productions, among others, sponge. The latter fact leads a physician of Geneva to try the new substance in goitre, for which burnt sponge had been previously a standard remedy. Its effects are decidedly favourable; and from this beginning its therapeutic qualities come to be investigated, with the result of its being admitted into the *Materia Medica*, as one of our most valuable remedies. In like manner, the examination of residuum resulted in the discovery of two other elements, selenium and bromine, the latter of which is beginning to be used in medicine.

But the general merits of chemistry are best shown by a glance at a few of the achievements of its cultivators, in favour of the arts and for the benefit of mankind. Need I do more than mention gas-lighting, the safety lamp, the chemical bleaching process, in order to call up, by association, the recollection of illustrious names, and of benefits conferred on man? What can be conceived more wonderful than that linen rags can be converted into more than their own weight of sugar by the action of one of our cheapest acids; and that saw-dust itself is susceptible of conversion into a substance resembling bread, and which, though not so palatable, is yet both digestible and nutritious. Possessed of this discovery, it may be truly said that, in this country at least, famine would be almost impossible. Another extraordinary achievement of the chemist is the solidification of carbonic acid gas.

If there be any invention greater than another, as determined by its stupendous effects and surpassing utility, it is that of the steam engine. As a machine, its investigation belongs to mechanics; but its moving power is steam, a subject appertaining to chemistry. Without a thorough knowledge of the chemical properties of this agent, the steam engine could not have been perfected; and for imparting this knowledge, we are chiefly indebted to the labours of Black and Watt.

Perhaps the most influential advance yet made in chemistry, was the discovery of the law of the definite proportions in which bodies unite with and displace one another. This law was in effect discovered by the German chemists Richter and Wenzel; but its importance does not appear to have been fully perceived by them. It was reserved for Dalton to demonstrate the law in all its generality, and to deduce from it a theory in explanation of the manner in which bodies unite; namely, that they combine by their smallest particles or atoms. This theory, called the atomic theory, is so perfectly

consonant with the law just mentioned, that it is universally admitted to be a just representation of the facts observed.

When we view nature in her two extremes of vastness and minuteness, the mind is filled with amazement and wonder. The distance of the visible fixed stars is so immense, that the diameter of the earth's orbit sinks, in comparison, to a mere point. When we bring the telescope to our aid, which supplies us, as it were, with a new sense, thousands of fixed stars are brought into view, immeasurably more distant than those visible to the naked eye. While the mind is painfully strained in endeavouring to form a conception of such vast distances, let us turn to the contemplation of the minuteness of a portion of the creation. What shall we say of living organized beings, several thousands of which, laid side by side, would not measure an inch? What conception can we have of the minuteness of light, which, travelling at the rate of one hundred and ninety-two thousand miles in a second, enters the eye, and does not tear the organ to pieces? By means of [a powerful microscope, we are enabled to magnify more than a thousand times in linear dimension; and hence a particle, presenting a surface a thousand times smaller than that of the smallest atom of matter visible to the naked eye, would be seen by the aid of that instrument.

Astronomy is the most perfect of the physical sciences. The heavenly bodies are regulated by one grand law, and by the application of mathematical science, all their motions are determined by rigid calculation. It is the privilege of a few great intellects only, to master this sublime science; but we who cannot follow them, while we bow to their superiority, feel convinced of the truth of their results, from the exactness of their calculations in aid of navigation, and from their ability to predict eclipses.

The laws of science, when carefully ascertained, have often a reflex operation in foretelling discoveries, and correcting the results of experiment. Thus, the combustibility of the diamond was inferred by Newton from its great refracting power, long before it was proved to be so by the Florentine Academicians in 1694. Again, Hutton, in his theory of the earth, having assumed as a fact the fusion of marble, was charged with making an erroneous conjecture; as marble, it was said, is converted into lime by high heats, instead of being fused. But he contended that marble, subjected to great pressure, which would retain the carbonic acid, would fuse without decomposition. Now this very conjecture was fully verified by experiment, in the next generation, by Sir James Hall, who suc-

ceeded in fusing different kinds of limestone, subjected to artificial pressure. As an example of the correction of experiment by the application of a law, we may instance the discrimination of two crystalline minerals by Haüy, by means of a slight difference in their angles. This led him confidently to infer that their composition was not identical; and to put his inference to the test of experiment, he enlisted the services of Vauquelin to repeat the analysis of the two minerals. Twice it was repeated without confirming his conjecture; but the crystallographer felt so confident in his principles, that he insisted upon having the analysis performed a third time; and now Vauquelin was successful in detecting a difference in their composition. In like manner, when an analysis does not support the equivalent property of the combining numbers, it is held to be inaccurate; and the chemist returns to his labours with entire confidence that his results, if correctly obtained, will not contradict this well established law.

In regard to the investigation of nature in several of her departments, some well-meaning but misguided persons are apt to ask "cui bono." To such mere utilitarians, the idea of investigating nature from a pure love of truth, with no other motive than to enjoy the contemplation of her harmonious laws, seems perfectly absurd. But, independently of any such abstract considerations which animate ardent and inquiring minds, it may be asked, can we be certain that an observation, a fact, or a principle shall never benefit mankind; although its utility is not obvious at first. We observe a man laboriously traversing a region of country, picking up stones and fragments of rocks. He is set down by the ignorant as insane; by those somewhat better informed as a misguided enthusiast; and the general inquiry is "cui bono,"—to what practical end is all this labour? This solitary student of nature is collecting the facts, which may determine some point in relation to the order of the superposition of rocks; and his results may decide where mining operations may be successfully carried on, and where similar attempts can only end in loss and disappointment. Again, the chemists discover four metals in the native platinum grains, and the discovery is hailed as a trophy to science; but we are again met by these cavillers with the question, "cui bono." We answer that, after the lapse of many years, palladium is found to be the best metal for the graduation-plates of nice instruments, and for the beams of delicate balances; and an alloy of iridium and osmium, on account of its hardness, the best material for the nibs of metallic pens. Every

child is familiar with the pleasing experiments founded on the attraction of the magnet for iron and steel; but the fact has been applied in a way productive of great utility. Those engaged in pointing needles by grinding, are subjected to the deleterious effects of the excessively fine dust of steel which is abraded in the operation. This, being inhaled, in spite of every guard which had been devised, was sure to produce disease, and sacrifice the life of the workman at an early age. At last the happy thought occurred to some one of covering the face with masks of magnetized steel wire, by which simple expedient, the hurtful particles were effectually arrested, and the workman saved from their destructive influence.

We shall adduce but one more instance of the folly of sneering at the students of nature, because we do not foresee what useful results may arise from their labours. In 1752, a printer of this city, but also an ardent lover of science, is seen, not far from the place where we are now assembled, engaged with his son in flying a kite, just on the eve of a thunder storm. Certainly, it will be exclaimed, there can be no possible use in this; and the weather would seem to be very unpropitious for engaging in such a pastime. The kite is raised, and a sublime result follows. Like another Prometheus, the experimenter draws down the fire of heaven, and demonstrates, by this simple expedient, the identity of electricity and lightning. But his results do not stop here. By an admirably devised train of experiments, he proves the power of pointed metallic rods in drawing off electricity gradually and safely; and applying these principles, he invents the lightning rod. Twenty years afterwards, this same printer is seen in London, defending the rights of his country at the British court, and now, in the possession of a wide-spread reputation, sustaining with equal honour the parts of philosopher and statesman. While there, the propriety of terminating lightning rods with points instead of knobs, is called in question, and a keen controversy ensues. The royal family declares in favour of knobs, and the pointed conductors are taken down from the Queen's palace. The dispute brought out the wits of the day, and gave rise to the following epigram, which, perhaps, has sufficient point to be repeated here.

“ While you, great George, for safety hunt,  
And sharp conductors change for blunt,  
The empire's out of joint;  
Franklin a wiser course pursues,  
And all your thunder fearless views,  
By keeping to the *point*.”

The achievements of man in conquering nature are truly wonderful. No enterprise seems too vast for his attainment. See him at one time penetrating to great depths in the earth; at another, apparently reversing the law of gravitation, ascending to the height of between four and five miles into the atmosphere. Observe him descending to considerable depths in the sea, piercing mountains with tunnels, making roads under large rivers, and traversing the ocean with great speed by the power of steam. What can be conceived more surprising than the results of the Daguerreotype, by which landscapes and miniatures are taken with perfect fidelity in a few seconds, by the effects of light on certain chemical agents applied to a metallic plate. Many of the discoveries of modern times would have been deemed miraculous by the ancients. And yet there are some who contend for the superiority of the ancients over the moderns. We certainly have not deteriorated in stature; for the mummies of Egypt show that the men that lived three thousand years ago were about the same height as those of the present day. If the ancients can boast of Archimedes and Aristotle, may we not instance Newton and Laplace? And if greatness of soul and love of country are to be taken as the standard, and we are reminded of Cincinnatus and Plato, may we not confidently point to Washington and Franklin?

In regard to our own country, it is true that our scientific pretensions are but moderate. In astronomy and chemistry, and, indeed, in the physical sciences generally, we receive almost all our light from Europe, and shed little in return. It is in the application of mechanical science to useful purposes that we excel, and it is by the invention and improvement of useful machines that we are enabled to pay, in part, the balance of science which is against us. That we have paid off a large portion of this scientific debt, may be confidently asserted; and for this result we are principally indebted to the genius of Fulton.

It is a curious fact that Darwin predicted the triumphs of steam, in its application to navigation and road-travelling, as early as the year 1788, in the following lines, contained in his "Botanic Garden:"

"Soon shall thy arm, unconquered steam! afar  
Drag the slow barge, or drive the rapid car;  
Or on wide-waving wings expanded bear  
The flying-chariot through the fields of air.

Fair crews triumphant, leaning from above,  
 Shall wave their fluttering 'kerchiefs as they move;  
 Or warrior-bands alarm the gaping crowd,  
 And armies shrink beneath the shadowy cloud."

The further prediction contained in these lines, that balloons would one day be propelled through the air by steam, has not been realized, though the achievement is by no means impossible.

In the topics of this address, I have been somewhat discursive, availing myself of the privilege usually conceded on similar occasions. Accordingly, I have alluded to several departments of general physics, as well as to chemistry.

In the course I propose to deliver in this college, I shall have particular view to the applications of chemistry to medicine. A general view of chemistry will be presented; but those parts of the science which have little or no bearing on medicine will be slightly touched upon; while the medical applications will be fully given.

And now, Gentlemen, in conclusion, allow me to add, that I enter upon my labours with the firm resolution to perform my duty. But permit me to remind you, that our duties and obligations are reciprocal, and hence I shall expect from you respectful attention and kind support. Recognizing, in the commencement, our mutual obligations, and judging leniently our mutual imperfections, our intercourse must needs be harmonious, and our labours crowned with success.

Dec. 18, 1848.



